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WARFARE IN ECOLOGICAL PERSPECTIVE

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Is looking at warfare in an ecological perspective likely to lead to generalizations of broad scope and applicability, either about warfare itself or about the dynamics of social and ecological systems? The present review was undertaken with this as a principal question in mind. The descriptive material used here is drawn mostly from accounts of the warfare of nonwestern societies with which I as an anthropologist am familiar.

Some of the generalizations that have already been put forth, ostensibly as the result of consideration of warfare in ecological perspective, have met serious objections. There are, for example, statements to the effect that population pressure is the underlying or principal cause of warfare either in all societies or in some broad category of societies, such as "primitive" or "barbarous" ones (13, pp. 227, 228; 14; 18; 26; 42, pp. 4–5). These generalizations have received empirical refutation in the form of evidence that war occurs even when appreciable population pressure is absent and when none of the belligerents either needs or seeks more land or other resources (9; 24, p. 166; 35, pp. 520–22). If one adopts a philosophical position from which the world is seen as composed of continuous processes and feedback systems, the generalizations are objectionable on grounds that they are based on the assumption that war may be usefully regarded as a discrete phenomenon for which there must be specifiable, discrete causes. How analysis is constricted by such an assumption is a matter to which I shall return.

The ecological considerations on which certain other currently popular generalizations about warfare are based have been confined for the most part to speculative reconstructions of the remote past. I am referring here to interpretations such as Ardrey's, whereby human aggression and warfare are seen as originating in (and persisting from) the hunting and meat-eating adaptations made by our primate ancestors to conditions of drought in Pliocene times (2). This is not the place for any extensive criticism of Ardrey's interpretations or of the similar views set forth by Lorenz (20) and others. [An anthology of critiques of these views is available

(23).] Suffice it to say that in the present article we will not be content to use an ecological perspective only for events that happened millions of years ago. Instead we will ask questions about the place of warfare in people's systemic responses to perturbations much more recent than the droughts of the Pliocene. This means, among other things, that we will consider the possibility that some recent warfare has operated within adaptive systems and has not been simply an expression of genetically programmed drives uselessly or deleteriously persisting from much earlier times.

The concern with people's responses to perturbations is in accord with the focus of ecologists—including human ecologists like Rappaport (33) and Flannery (10)—on the means used by adapted organisms to counteract departures from steady state conditions. In some of the anthropological literature war itself has been regarded as a means for restoring certain variables to states or ranges advantageous for the people in question; it is appropriate here to note briefly, with the help of earlier review articles on primitive warfare (44–46), a few of the statements and hypotheses from this literature to see whether they bring us closer to generalizations of broad scope and applicability. Various writers have, for example, set forth hypotheses to the effect that war breaks out in response to stresses associated with the shortage of land or of other vital resources, and leads to relief from those stresses by virtue of reducing inequalities between groups in their possession of or access to the resources in question. Thus shortages of camels among Bedouin groups and of horses among Plains Indians have been hypothesized to be corrected by means of stock-raiding activities undertaken by the men who are short of animals against enemies more abundantly supplied (40; 41; 49, note 14).

With respect to certain primitive peoples who are horticulturalists rather than pastoralists, similar hypotheses have been presented but with land rather than camels or horses as the vital resource being redistributed as a result of warfare. Thus Meggitt (21, 22) has offered this kind of hypothesis with reference to the Mae Enga people of the New Guinea highlands; I myself have offered it as possibly applying to the warfare of various primitive people who have in common the practice of shifting or slash-and-burn cultivation (43). According to these hypotheses, as distinct from the generalizations noted earlier, war may be a recurrent response to certain kinds or magnitudes of population pressure, but is not necessarily always caused solely or mainly by such pressure. On the other hand, hypotheses also have been put forward about war as a corrective response to problems not of overpopulation but of underpopulation. Autonomous local groups are small enough in much of the primitive world to be subject to considerable fluctuations in size, sex ratio, and age distribution as a result of chance variations in natality and mortality; it has been noted that some such groups, as, for example, some Indian groups in central Brazil (28, p. 473), compensate for the effect of these variations by resorting to warfare that involves taking captives belonging to appropriate age and sex categories.

Are such hypotheses likely to bring us closer to generalizations of broad scope and applicability? If what is sought are generalizations about the relations between warfare as one variable and another specific variable such as population pressure,

the prospects are not encouraging. This is indicated merely by the fact that warfare can be hypothesized to be a response to population pressure in some cases and to population shortage in others. It is, moreover, possible to cite numerous alternatives to warfare that have developed in various societies as solutions to problems such as those associated with population pressures (51, chap. 31). This is in accord with what is sometimes described in more general terms as the "principle of multiple solutions for adaptational problems in evolution," paralleled by the sociological concepts of "functional alternatives" or "functional equivalents" (17, p. 285; cf 7). There cannot be anything surprising in this to anybody who has been duly impressed that cultural evolution, much like biological evolution as described in Simpson's classic discussion of the subject (36, chap. 4), is opportunistic. (For some discussion of parallels between cultural and biological evolution in this respect, see 50, pp. 486–87.)

The indisputable fact that there are cases in which the hypotheses of the preceding paragraphs do not hold has been regarded by some students of war as evidence that useful generalizations cannot be developed from analyses of the means whereby departures from steady state conditions are counteracted (1, 11, 12, 19). It must be said, however, that this conclusion is not inescapable. An alternative possibility is that the categories students of war have been employing in their analyses of homeostatic ecological processes have been inappropriate for the development of generalizations. What categories might be used instead? In the remainder of this article, materials and arguments will be put forward in favor of the following procedures:

1. Viewing war not simply as something that either does or does not occur, but rather as a process;
2. Viewing it, moreover, as a process which may be one of a number of processes employed in people's responses to particular kinds of perturbations;
3. Making our generalizations refer to temporal and other properties that the processes evince in operating adaptively to counteract the perturbations.

WAR AS A PROCESS

So-called conflict theorists and the many scholars who have asked about causes of war have seldom looked at war as a process. Instead they have generally accepted, implicitly or explicitly, a simple dichotomy between war and peace. One author, reviewing contributions to the *Journal of Conflict Resolution* during the years 1957–1968, remarked: "I get the feeling that, for most *JCR* contributors, once a war happens, it ceases to be interesting" (8, pp. 476–77). Commenting on this, a historian has recently suggested that the conflict theorists' neglect of the dynamics of war may reflect a prevalent notion that "once a war breaks out, its end is inherent in its beginning—simply a mindless, inescapable playing-out of forces set in motion at the outset . . . " (4, p. 15). Even with the kind of awareness of escalation that has been forced upon all of us by recent examples of the development of small wars into a larger one in southeast Asia, the literature on escalation remains, as remarked by the editors of a recent book on *Theory and Research on the Causes of War,* "quite scanty" (30, p. 57). To these editors, the study of "events that follow after the entry

of a state into war" is outside the scope of their volume. The effect of this restriction is, among other things, a failure to consider possible differences between the factors affecting entry into war and those affecting escalation. The defective analysis that can result from such failures is illustrated below.

In a few recent anthropological studies of warfare the scope is less restricted; a number of different grades of violence have been distinguished, separate causes have been sought for fighting or warfare at each grade, and, in some cases, escalations from grade to grade have been noted. Thus Otterbein's study of the warfare waged by the Higi people of the Mandaras mountain range of eastern Nigeria deals with the characteristics, social and political contexts, causes, and outcomes of three types of armed combat within communities and of two types of intercommunity fighting, one of which, raids, could lead to the other, battles (29).

Chagnon, in his reports of the warfare of the Yanomamö Indians of the Venezuelan and Brazilian tropical forest (5, 6), describes a "graded series" of intervillage contests that includes: relatively innocuous chest-pounding and side-slapping duels; contests with clubs; contests with spears; raids; and, what for the Yanomamö is the "ultimate form of violence," treacherous feasts at which the hosts and their collaborators kill the male guests and abduct the women. Proximate causes of each kind of fighting have been recorded by Chagnon, and he has also noted that the form a fight takes "can be escalated to the next, more serious, level" (6, p. 132). However, while responses to perturbations of man/land ratios have been discerned by some interpreters of Chagnon's materials on Yanomamö warfare and war-related migrations (e.g. 15, pp. 29–30), he himself relates the Yanomamö war process as a whole only to the need for shows of force by independent villages in a milieu of chronic warfare. He states, moreover, that "the causes of a fight are soon forgotten once it starts, and it is perpetuated largely by reasons of its own being" (6, p. 132). Chagnon's study is valuable in the context of the present article, more for the documentation it provides of war as a process than for analysis of the relation of that process to other ones and to environmental perturbations.

My own case studies can be usefully introduced at this point, for they deal both with the war processes and with their place in larger homeostatic structures or systems. The perturbations with which the studies happen to be mainly concerned are those associated with population pressure, but material from the studies can be used illustratively in raising questions about adaptive responses to perturbations in general. One should keep in mind that the object here is definitely other than developing the kinds of generalizations about population pressure that were noted critically in the preceding section.

An article reporting on one of the case studies describes a multiphase war process operating among the Maring people of the Bismark Mountain region of eastern New Guinea (48). These people are slash-and-burn cultivators of tuberous staples and other crops and also engage in pig husbandry, pandanus tree cultivation, and some gathering of wild plant foods and hunting of feral pigs, small marsupials, and birds. The total Maring population of 7000 is unevenly distributed within a rugged forested area of 190 square miles; in the more densely settled parts the size of autonomous local groups ranges from about 200 to 850 people, but there are some smaller

Maring groups in the less densely settled lower altitudes of the region. In Maring wars, which were still being fought just a few years before the beginning of anthropological field work among the Marings in 1962, the major belligerents always were autonomous local groups with adjoining territories.

Features of the Maring war process that are significant in the present context include the following:

1. *The later phases of the process that involve heavy mortality and sometimes lead to territorial conquests cannot occur unless preceded by periods of weeks or months marked by rather ritualized hostilities in which mortality is low.* In many Maring wars the first phase of these hostilities consisted of a series of "nothing fights," day-long bow and arrow encounters at a prearranged battleground. This phase could continue for many days and even weeks. The succeeding phase consisted of "true fights," in which the arms employed at the battleground were expanded to include weapons of close combat and the warriors sometimes made quick charges into the enemy lines. However, in most of the fighting of this phase the combatants remained in static positions behind large shields and, accordingly, engagements could take place day after day for weeks and even months without heavy casualties. Moreover, hostilities could, by mutual agreement, be suspended for a day or more during this phase in order to allow the combatants to repaint their shields, to attend to rituals in connection with casualties, to rest, or to attend to agricultural tasks. Mortality became heavy, as a rule, only when there was escalation to a phase which can be called *routing.* In this, the warriors of one side went to the enemy settlements, burned the houses there, killed indiscriminately any men, women, or children that they found, and, after having put the survivors to flight, destroyed gardens, fences, and pandanus groves, and defiled the burial places.

2. *Escalations from phase to phase in the war process are not inevitable: there is no "inescapable playing out of forces set in motion at the outset."* A return to peace is possible from each of a number of the phases of war: from nothing fights, from true fights, and from the phase of raids which, especially in the low-density parts of the Maring area, is an alternative to nothing fights and true fights as antecedents to routing. (For further description of raids, see 48, pp. 11–12.) Decisions by both sides in favor of armistice were influenced by assessments of relative fighting strength, numbers of casualties, and the nature of previous relations between the antagonists. Moreover, from the refuging that followed routing there also could be a return to the status quo ante bellum. It might be expected that the land of a routed group whose members had gone into refuge would have been immediately taken by the victorious warriors. The latter, however, were constrained by Maring notions about the continuing dangerousness of the ancestor spirits of displaced enemies and, accordingly, would not attempt to move into the enemy land until a later time, perhaps years later, when they could count on the support of their own ancestor spirits because of having made appropriate sacrifices of pigs to them in a long sequence of ceremonies. (For more on these ceremonies see 31.) If, however, the routed group succeeded in rehabilitating itself and returning to its old lands before any move by the victorious warriors, no territorial annexations would take place.

3. *The causes of entry into war are not the same as the causes of escalation from one phase to another of the war process.* The Maring data show that wars which begin as revenge for murders or other offenses committed against the group—and these were almost always what led Maring men to war—can end with territorial conquests. Evidence which is relevant here can be cited also from my case study of Maori warfare (47). This shows that fighting for revenge in the pre-European war process of the Maoris of New Zealand became fighting for territory whenever some attacked groups failed to defend themselves stoutly or to retaliate firmly and their enemies perceived this and responded with conscious attempts to conquer their land. It may be of incidental interest to note that such evidence raises, as some scholars have recognized (e.g. 25), serious questions about the validity of cross-cultural or cross-societal studies that depend on the fixed assignment of the warfare of various societies to one or another of a limited number of such categories as "revenge warfare" (e.g. 27, p. 105; 51, p. 373). The case studies point to the possibility that the ethnographic reports on which the assignments to the categories are based may be describing the causes of only the first phases of war processes; fighting for blood revenge, magical trophies, or sacrificial victims can become something else if there is escalation to the later phases.

4. *Perturbations can be counteracted when there is escalation to the final phase of the war process.* The Maring war process has been described as sometimes ending in territorial conquests, but some students of war (e.g. 16, p. 132), impressed by differences in military power rather than in population pressure per se, have questioned whether the fact of such conquests has implications concerning relief from the stresses of population pressure among people like the Marings. What is shown by the Maring case study (and also by the Maori one), however, is that only if there were indeed disparities among neighboring groups in such variables as military strength could relief from population pressure be obtained by means of territorial conquests. The study also shows that warfare, in its early phases and (if there was escalation) its later ones, was a test for disparities in these variables and thus enabled groups under pressure to discover at whose (if anybody's) expense territorial expansion might take place. The specific data giving substance to these generalizations are available in the reports of the case studies (47, 48).

For the purpose of illustration here, we can develop several brief scenarios in which the protagonists are the members of an imaginary group, A, and are beginning to experience the adverse effects of increasing population pressure (more work required in subsistence labors, more intragroup competition over resources, and perhaps some environmental deterioration and some reduction in food supplies). Members of the group commit acts of aggression against other groups, although not necessarily with any consciousness of possible connections between their actions and the pressure that is incipiently affecting them. These aggressive actions may be homicides, trespasses, and raids constituting the initial provocations to warfare with other groups, or they may be escalations of a war that broke out before the effects of population pressure began to be felt. The groups against which these actions are directed include ones that defend themselves stoutly and perhaps counter with aggressions against A; let us call these the B groups. There may, however, also be

C groups, distinguishable on the basis of their responding to A's aggressions neither with strong defenses nor with counter-aggressions. If this should be the case, A attempts, without providing signs of weakness to the B groups, to discontinue actions against them and to concentrate on the C groups. If one of these, abashed by A's show of force either in repeated hostile incursions or in unavoidable (and possibly escalating) open warfare, abandons its land and is unable to return to it after a due period of refuge elsewhere, A takes the land and thereby finds relief from population pressure. The C group, by failing the tests for military power, has become the group at whose expense A's relief is achieved.

In a somewhat different scenario A is still suffering from population pressure but has betrayed signs of possible weakness to a B group with which it has become embroiled in hostilities. The result might be that A itself becomes, after further testing in warfare, the group at whose expense another group (the B group) extends its territorial boundaries and finds relief from population pressure. There may be concurrent relief for members of A also, i.e. if they take refuge in unpopulated or underpopulated areas. Alternately, they may seek refuge with some large group that is likewise suffering from population pressure. With the pressure intensified and its military power augmented by the arrival of the refugees, this group may then in turn undertake to test itself and to fight against other groups and the end result can be territorial conquests and relief from population pressure both for itself and for the A group people to whom refuge has been given.

In a third possible scenario A is again feeling the effects of population pressure but this time finds itself, sooner or later, in deadlock with every group whose power it tests. Under these circumstances warfare cannot lead to territorial conquests providing relief from pressure. If relief comes it is likely to be less through the operation of behavioral processes than through the operation of various physiological processes that may limit population by leading to lowered resistance to disease and death, lowered fertility, and lowered viability of offspring.

5. *The war process counteracts perturbations after other processes have failed to counteract them.* Just as the physiological processes mentioned above may not become the major means of counteracting the stresses of population pressure until there has been an unsuccessful recourse to the war process for counteracting them, so the war process itself does not become the major means until other processes have been tried. As the scenarios have indicated, a group in need of additional territory may have to test itself in one or more phases of war against a series of antagonists before it finds a group at whose expense territorial conquests can be achieved. The fact that the war process is a multiphase one in which the inception of hostilities does not lead inevitably to escalations from phase to phase means, in general, that prior to any culmination of the process in territorial conquests there is time for recourse to other (nonwar) processes for seeking relief from stresses associated with population pressure. These other processes, which have been described elsewhere (e.g. 32), involve various kinds of peaceful land transfers between individuals and between groups and also peaceful shifts of residence. While these processes need not be considered in detail here, it should be noted that they are important in connection with the kinds of generalizations that are discussed in the next section.

TOWARD BROADER GENERALIZATIONS

The analysis of homeostatic ecological processes calls for consideration not only of how human beings or other organisms respond to perturbations, but also of how they maintain the capacity to respond adaptively. Such maintenance means, among other things, leaving resources available for responding to future stresses after present ones have been dealt with; it therefore may be assumed that successful human populations, like successful animal species (cf 37), have evolved mechanisms for achieving at least rough correspondences between magnitudes of perturbations and magnitudes of responses to them. Some achievement of such correspondences is illustrated by the materials presented and discussed in the preceding section insofar as it is shown there that not all warfare but rather only some later and not inevitable phases of the Maring war process are expensive in resources and lives, and that these later phases are kept from occurring before less costly and not necessarily warlike mechanisms have had a chance to counteract the stresses at hand.

For discerning the directions in which fruitful generalizations may lie it can be useful to examine materials on war processes that, unlike the Maring one, lack the temporal and other properties which make them operate adaptively in response to perturbations. Such materials are, in fact, available from the Maori case study (47). The materials show how the operation of a multiphase war process was disrupted when the indigenous weapons of wood, stone, and bone were replaced in Maori warfare by muskets brought to New Zealand by Europeans in the early years of the nineteenth century. In pre-European times the warfare that produced heavy mortality and sometimes enabled victorious groups to take land from defeated ones (and thereby to obtain relief from the stresses of population pressure) occurred, as a rule, only after extended periods of raids and counter-raids for revenge. However, when some Maori groups living by the ports of call for European trading and whaling vessels acquired muskets they quickly put the weapons to use in fighting to gain revenge from enemies at whose hands injuries had been suffered either recently or many years before. The example of these groups was followed by others when they acquired muskets. Fighting for revenge became both more frequent and much more lethal throughout New Zealand. It has been estimated that in just two decades of such fighting with muskets tens of thousands of Maoris, or between one quarter and one half of the total Maori population of New Zealand, perished—some in battle, others because of starvation and disease resulting from the neglect of subsistence labors while warfare and arms races (producing goods that could be traded to Europeans for guns and ammunition) were going on.

What the introduction of muskets had done was to make costliness in resources and lives an attribute of all warfare rather than of just the later phases of a multiphase war process. The correspondence between magnitude of perturbations and magnitude of responses to them had been severely diminished, and it is conceivable that the Maoris would have been brought close to extinction if they had continued to use the muskets in fighting for revenge; they would have been succumbing to the effects of new stresses that they themselves were producing and for which they had not yet developed response mechanisms. However, after two decades the fighting

stopped. Seeing destruction and death on all sides many Maoris turned to Christianity for a new set of values whereby not taking revenge for injuries suffered could, most opportunely, be justified. Firearms were cast aside and were not used again until years later when the Maoris fought to prevent their lands from being taken by the European settlers who had been coming to New Zealand in increasing numbers since 1840. The recourse to firearms when the Maoris' lands were in jeopardy may be regarded as a return to responses appropriate in magnitude to the magnitude of the perturbations.

Unfortunately the number of case studies in which war has been analyzed as a process in relation to other processes and to environmental perturbations is very limited. However, from the two case studies considered it can be seen that the timing of the various phases of multiphase processes responding to perturbations and the commitments of resources entailed by each of the phases can have important implications for the adaptedness of human populations. If we merely note additionally that there may be other cases in which the ultimate phase of a war process provides solutions to problems not of population pressure but of population shortage [as perhaps among the Marind-Anim of the southern coast of West New Guinea, a people whose elaborate rituals culminated sometimes in headhunting expeditions to distant places where children were captured for adoption (3)], we can see again that categories or variables like population pressure are too specific for inclusion in generalizations that are to have broad scope and applicability.

The variables to which the materials and arguments reviewed in the present article point instead are those such as the magnitude and duration of perturbations, the magnitude and reversibility of responses to them, and the temporal order in which responses of different magnitudes occur. These, in fact, are variables that must be dealt with to develop further and to test some potentially important generalizations that have already been put forward by social scientists or human ecologists whose primary focus has been not on population pressure and, for that matter, not on war processes either. Among examples are statements to the effect that selection favors structures using "expensive" control mechanisms only when they are needed —a "principle" which Stinchcombe, in a sociological discussion, illustrates by citing the infrequent recourse to political purges in societies (39, pp. 145–46). There also are similar but broader generalizations about how the adaptiveness of living systems depends on maintaining a general homeostasis deriving from a certain ordering of processes and of the systemic components in which they occur (34; cf 38, p. 69). It should become possible to develop further such generalizations about adaptive responses and to make testable predictions on the basis of them as the enumeration and quantification of relevant variables proceed. All of this, as we have been suggesting here, is work to which the analysis of war processes in an ecological perspective can contribute.

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